PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference FP21080	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. **PCT**/AU2005/000099	International filing date *(day/month/year)* 28 January 2005	Priority date *(day/month/year)* 28 January 2004

International Patent Classification (IPC) or national classification and IPC

Int. Cl.

C22B 3/40 (2006.01) ***C22B 23/00*** (2006.01)

Applicant

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION et al

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of **3** sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. [X] *(sent to the applicant and to the International Bureau)* a total of 6 sheets, as follows:
      - [ ] sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

[X]	Box No. I	Basis of the report
[ ]	Box No. II	Priority
[ ]	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
[ ]	Box No. IV	Lack of unity of invention
[X]	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
[ ]	Box No. VI	Certain documents cited
[ ]	Box No. VII	Certain defects in the international application
[ ]	Box No. VIII	Certain observations on the international application

Date of submission of the demand 25 August 2005	Date of completion of this report 01 February 2006
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer **ASOKA DIAS-ABEYGUNAWARDENA** Telephone No. (02) 6283 2141

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/AU2005/000099

Box No. I Basis of the report

1. With regard to the **language,** this report is based on:

[X] The international application in the language in which it was filed

[ ] A translation of the international application into , which is the language of a translation furnished for the purposes of:

[ ] international search (under Rules 12.3(a) and 23.1 (b))

[ ] publication of the international application (under Rule 12.4(a))

[ ] international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

[ ] the international application as originally filed/furnished

[X] the description:

pages 1-4, 6-28 as originally filed/furnished
pages* 5 received by this Authority on 25 August 2005 with the letter of 25 August 2005
pages* received by this Authority on with the letter of

[X] the claims:

pages as originally filed/furnished
pages* as amended (together with any statement) under Article 19
pages* 29-33 received by this Authority on 25 August 2005 with the letter of 25 august 2005
pages* received by this Authority on with the letter of

[X] the drawings:

pages 1/9-9/9 as originally filed/furnished
pages* received by this Authority on with the letter of
pages* received by this Authority on with the letter of

[ ] a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. [ ] The amendments have resulted in the cancellation of:

[ ] the description, pages
[ ] the claims, Nos.
[ ] the drawings, sheets/figs
[ ] the sequence listing *(specify)*:
[ ] any table(s) related to the sequence listing *(specify)*:

4. [ ] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

[ ] the description, pages
[ ] the claims, Nos.
[ ] the drawings, sheets/figs
[ ] the sequence listing *(specify)*:
[ ] any table(s) related to the sequence listing *(specify)*:

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/AU2005/000099

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-36	**YES**
	Claims		**NO**
Inventive step (IS)	Claims	1-36	**YES**
	Claims		**NO**
Industrial applicability (IA)	Claims	1-36	**YES**
	Claims		**NO**

2. Citations and explanations (Rule 70.7)

NOVELTY(N)

Claims 1-36
D1- Derwent Abstract Accession No. 84-109393/18, Class E31, J01, M25, ES 8401143 A(Schortmann P C) 16 February 1984
D2- US 3903235 (Cardwell et al.), 2 September 1975
D3- GB 2109357 A (Council for Mineral Technology (South Africa)), 2 June 1983
D4- WO 1998/014623 (International Curator Resources Limited), 9 April 1998
D5- CA 1223242 A (Granted to Majesty (Her) in right of Canada as represented by the Minister of Energy, Mines and Resources, Canada), 23 June 1987
D6- WO 2002/022896 A1 (Commonwealth Scientific and Industrial Research Organisation), 21 March 2002

None of the above documents (D1-D5) disclose a process of solvent extracting nickel and cobalt from a leach solution, wherein the solvent contains a carboxylic acid, an aliphatic hydroxyoxime and a kinetic accelerator.

INVENTIVE STEP(IS)

Claims 1-36 : As above

According to one embodiment, the recovery step comprises selective stripping of the organic phase to separate the cobalt from the nickel. The cobalt may thereafter be recovered from the loaded aqueous strip liquor, and the nickel recovered from the selectively stripped organic solution by bulk stripping.

Brief Description of the Drawings

The invention will be described in further detail with reference to the following figures which relate to embodiments of the invention.

Figure 1 is a schematic flow chart of the steps of the process of one embodiment of the invention.

Figure 2 is a more detailed schematic flow chart of a part of the process illustrated in Figure 1.

Figure 3 is a schematic flow chart of a second embodiment of the invention, which is a variation on the process illustrated in Figure 2.

Figures 4 and 5 are graphs comparing extraction pH isotherms of metals using a comparative extraction system (Figure 4) and the extraction system containing Versatic 10 and LIX63 (Figure 5).

Figure 6 is a graph showing the stripping kinetics of metals from a loaded organic phase from the extraction system of a second embodiment of the invention.

Figure 7 is a graph showing the Extraction pH isotherms of metals from the organic phase of system of Figure 6.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A process for the separation of nickel, cobalt or both from impurity elements selected from one or more of calcium, magnesium, manganese and chloride contained in a leach solution, the process comprising the step of subjecting the leach solution to solvent extraction using a carboxylic acid, an aliphatic hydroxyoxime and a kinetic accelerator.

2. The process of claim 1, wherein the solvent extraction step comprises contacting the leach solution with an organic solution comprising the carboxylic acid, hydroxyoxime and kinetic accelerator.

3. The process of claim 2, wherein cobalt poisoning as a result of oxidation of cobalt(II) to cobalt(III) is avoided.

4. The process of claim 2 or claim 3, wherein all of an organic phase separated from the solvent extraction step is subjected to stripping with an acid solution to strip metals present from the organic phase.

5. The process of claim 4, wherein the stripping step is preceded by a scrubbing step.

6. The process of claim 4 or claim 5, wherein the stripping step is a selective stripping step.

7. The process of any one of claims 2 to 6, wherein the organic solution displays fast extraction kinetics for nickel, cobalt, copper, zinc and manganese.

8. The process of any one of claims 2 to 7, wherein the organic solution is in contact with the leach solution for a period of 5 minutes or less.

9. The process of claim 8 wherein the organic solution is in contact with the leach solution for a period of 3 minutes or less.

10. The process of claim 8 wherein the organic solution is in contact with the leach solution for a period of 2 minutes or less.

11. The process of any one of claims 2 to 10, wherein the organic solution comprises a stabilizer against hydroxyoxime degradation.

12. The process of claim 11, wherein the stabilizer reduces oxidation and/or hydrolysis of the hydroxyoxime.

13. The process of claim 12, wherein the stabilizer is an anti-oxidant.

14. The process of any one of claims 1 to 13, wherein the solvent extraction step effects extraction of a large proportion of the nickel, cobalt, copper and zinc into an organic phase, to the extent that these elements are present, with a large proportion of the calcium, magnesium, manganese and chloride being rejected to the aqueous phase.

15. The process of any one of claims 1 to 14, wherein the leach solution contains impurity elements selected from one or more of calcium, magnesium, manganese and chloride, optionally together with copper and/or zinc.

16. The process of any one of claims 1 to 15, wherein the leach solution is a solution that has been subjected to a preliminary iron and/or aluminium precipitation step to precipitate out iron and/or aluminium to leave an aqueous leach solution containing the target elements and impurity elements other than iron and aluminium.

17. The process of any one of claims 1 to 16, wherein the carboxylic acid is 2-methyl, 2-ethyl heptanoic acid or a cationic exchange extractant having extraction characteristics similar to 2-methyl, 2-ethyl heptanoic acid.

18. The process of any one of claims 1 to 17, wherein the hydroxyoxime is a chelating α-hydroxyoxime.

19. The process of any one of claims 1 to 18, wherein the kinetic accelerator increases the rate of extraction and/or stripping kinetics of nickel.

20. The process of any one of claims 1 to 19, wherein and the pH of the aqueous phase in the solvent extraction step is maintained in the range of from 5.0 to 6.5 to effect extraction of the cobalt and/or nickel into the organic phase.

21. The process of claim 20, wherein the pH of the aqueous phase in the solvent extraction step is maintained in the range of from 5.5 to 6.0.

22. The process of claim 21, wherein the organic phase from the solvent extraction step is subjected to scrubbing.

23. The process of any one of claims 1 to 22, wherein cobalt and nickel are extracted into the organic phase, and the organic phase is subjected to selective stripping to separate to a significant extent the cobalt from the nickel.

24. The process of claim 23, wherein the selective stripping comprises contacting the organic phase from the solvent extraction with an acidic aqueous solution to

yield (a) a loaded strip liquor containing cobalt, and (b) a selectively stripped organic solution containing nickel.

25. The process of claim 24, wherein the acidic aqueous solution used in the selective stripping has a pH in the range of 3.0 to 4.0.

26. The process of any one of claims 23 to 25, wherein the cobalt is recovered from the loaded strip liquor.

27. The process of claim 26, wherein the cobalt is recovered by cobalt precipitation.

28. The process of any one of claims 23 to 27, wherein the nickel is recovered from the stripped organic solution from the selective stripping step.

29. The process of claim 28, wherein the organic solution from the selective stripping step contains nickel and copper, and is subjected to stripping with an aqueous acid solution to separate the nickel into the aqueous phase with only a small amount of the copper, followed by ion exchange to remove the copper, and the nickel is recovered from an eluate of the ion exchange.

30. The process of claim 22, wherein the scrubbed organic solution is stripped to obtain (a) a loaded strip liquor containing nickel and cobalt, and copper and zinc to the extent that copper and zinc are present, and (b) a stripped organic solution.

31. The process of claim 30, wherein the loaded strip liquor is subjected to organophosphinic acid solvent extraction.

32. The process of claim 31, wherein the organophosphinic acid solvent extraction produces (a) a

loaded organic solution which contains cobalt (and zinc and copper, to the extent they are present), and (b) an aqueous raffinate containing nickel.

33. The process of claim 32, wherein the loaded organic solution from the organophosphinic acid extraction is scrubbed, the scrubbed organic solution containing cobalt (copper and zinc) is subjected to stripping with sulphuric acid at an appropriate pH, the loaded strip liquor containing cobalt (copper and zinc) is subjected to ion exchange to remove copper and zinc present, and cobalt recovered from the eluate.

34. The process of claim 33, wherein nickel is recovered from the aqueous raffinate from the organophosphinic acid extraction.

35. The process of any one of claims 1 to 34, wherein scrubbing is conducted on the organic phase after each solvent extraction.

36. A product recovered by the process according to any one of claims 1 to 35.